ATTACHMENT 2

– turbulent, where air is directly introduced into the reactor (Figure 150). A settling tank downstream is essential. The purification efficiency is limited.

2.2.4. Other systems

2.2.4.1. Biological discs

This method, which is also known as the Rotating Biological Contactor (RBC), goes back to the 19th century, to the work of Weigrand on the purifying capabilities of water mill wheels.

The biomass is attached to discs that turn around a horizontal axis and are partially bathed in the water to be treated (Figure 151). Rotation brings the biomass alternately in contact with the water to be treated and the oxygen in the air.

An electric motor usually provides the energy for the discs to rotate. Several methods have been designed to aid rotation and oxygenation by blowing additional air into pockets attached to some of the discs. The discs, which are made of polystyrene, PVC, or corrugated polyethylene sheets, are 2 to 3 m in diameter. They are spaced 2 to 3 cm apart and turn at 1 to 2 rpm.

A clarifier, designed for rising velocities of up to 2 $m.h^{-1}$, retains the excess sludge.

The absence of any stirring in the aeration tank:
- necessitates the presence of a primary settling tank;
- prohibits the recirculation of sludge after the clarifier.

These systems are often made up of several disc stages, the first of which remove organic carbon, and the last of which perform nitrification. Loadings are expressed in g BOD_5 per m^2 of disc surface per day. Loadings rarely exceed 25 to 30 $g/m^2.d$. With considerably lower loadings, nitrification is possible but the system is highly temperature-sensitive.

The advantage of this method is that it consumes little electrical energy (2 to 4 $W.m^{-2}$ of disc), but widespread use has been hindered by:
- the need to stabilize primary and biological sludge;
- the great difficulty in obtaining a treated municipal wastewater effluent with less than 40-45 $mg.l^{-1}$ BOD_5 without making heavy additional investments;
- the need to cover the discs to protect them against harsh weather.

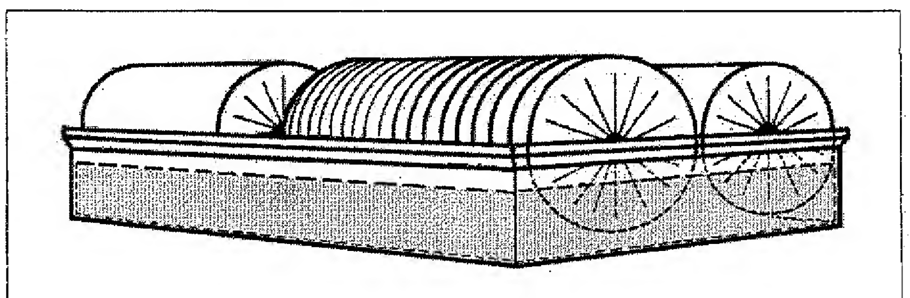

Figure 151: Biological discs

2.2.4.2. Submerged contact structures

This method consists in submerging in a tank of activated sludge a fixed or floating structure on which an additional biomass has developed, which is not required to pass through the clarifier. Thus, it is theoretically possible to improve the performance of a biological purification facility without enlarging the clarifier, which may be limited by the solids loading applied (see Page 164).

Another more promising application involves nitrification tanks that are fitted with these contact structures and placed downstream of a conventional facility removing carbonaceous pollution. This system can be compared with a method that is widely used in small facilities in Japan, where a final aeration tank fitted with honeycomb modules is located downstream of the small plant with no final settling tank.

The criteria determining the choice of contact structure are:
- the specific surface area. The growth of the biomass concentration depends directly on the surface area. Processes may be grouped on the basis of this criterion, which determines all the subsequent technological options;
- sensitivity to clogging and the possibilities of cleaning;
- the resistance to wear and tear;
- the material and installation costs.

The processes differ mainly in the type of materials used:
- flat materials. These processes use plastic fill similar to that used in trickling filters. The BOD loadings applied remain below 2 $kg/m^3.d$. The increase in the level of sludge is about 20 to 40% as compared to traditional activated sludge;
- filiform materials. The threads employed may be used in two ways:
  - by direct implantation of threads arranged in various ways (loops, clusters, etc.), mainly using the "ring-lace" technique.
  - by using 2 to 3 cm edge cubes made of polyurethane mesh.

  The major drawback of this method lies in the especially high risks of clogging and agglomeration, particularly with waters containing fibres, greases, etc.,
- floating materials.